#5

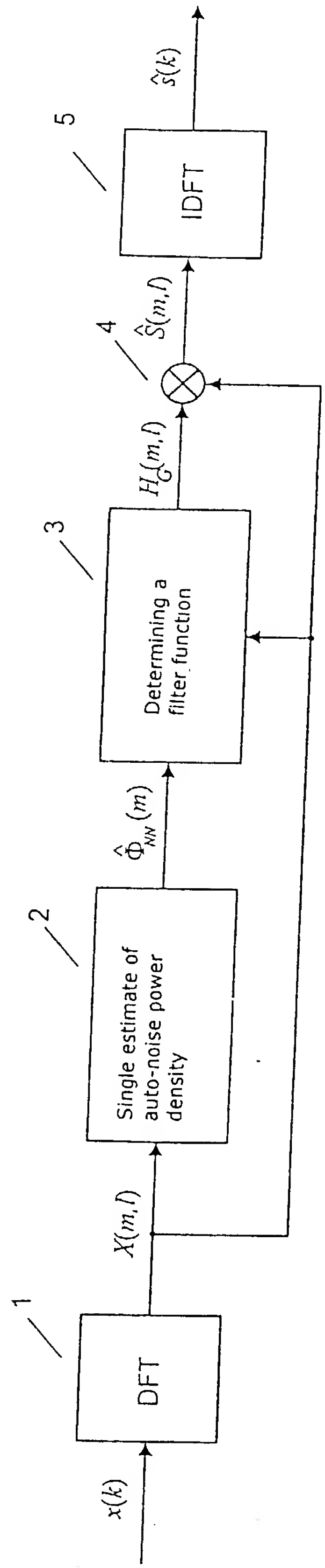
x(k)
1
DFT
X(m,l)
2
Single estimate of auto-noise power density
$\hat{\Phi}_{NN}(m)$
3
Determining a filter function
$H_G(m,l)$
4
$\hat{S}(m,l)$
5
IDFT
$\hat{s}(k)$

Fig. 1

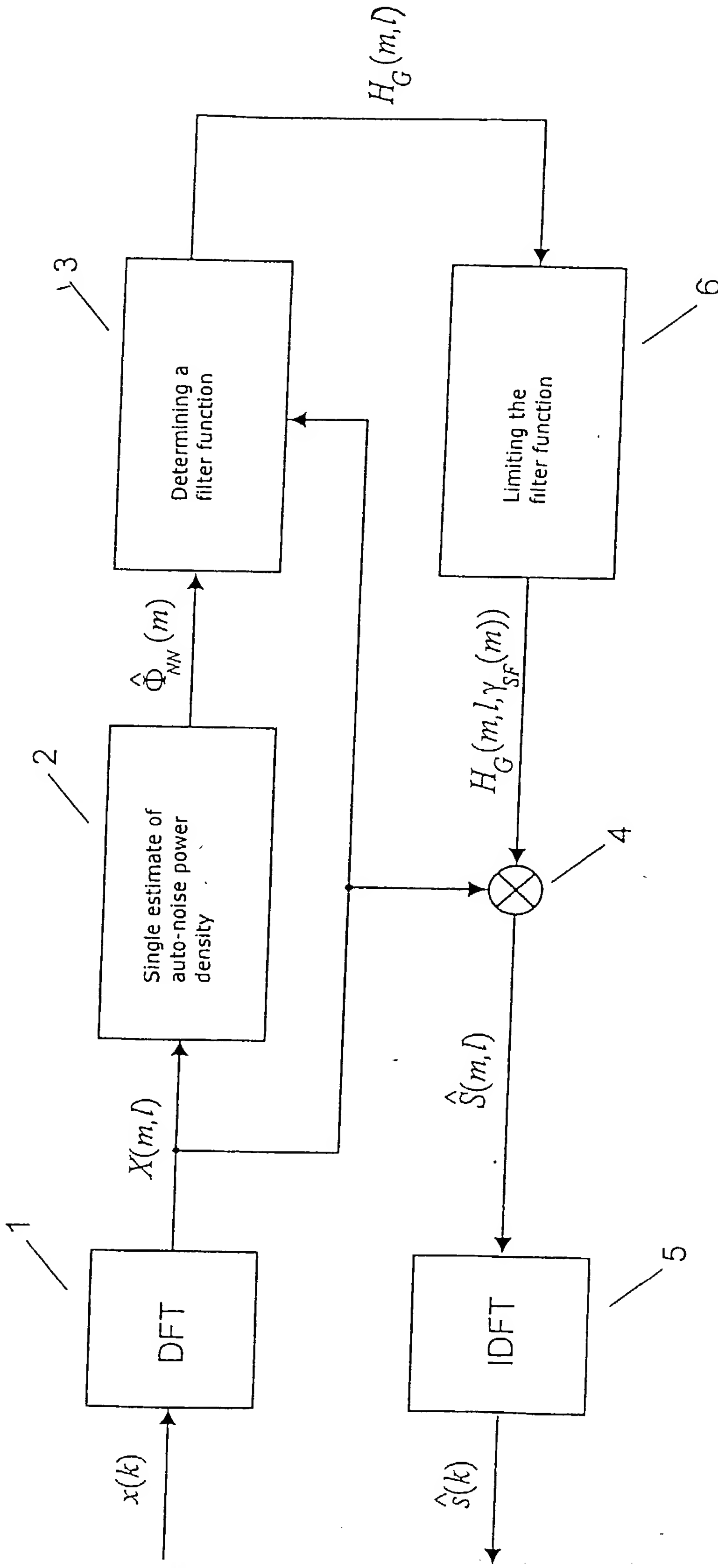
$x(k)$
DFT
1
$X(m,l)$
Single estimate of auto-noise power density
2
$\hat{\Phi}_{NN}(m)$
Determining a filter function
3
$H_G(m,l)$
Limiting the filter function
6
$H_G(m,l,\gamma_{SF}(m))$
4
$\hat{S}(m,l)$
IDFT
5
$\hat{s}(k)$

Fig. 2

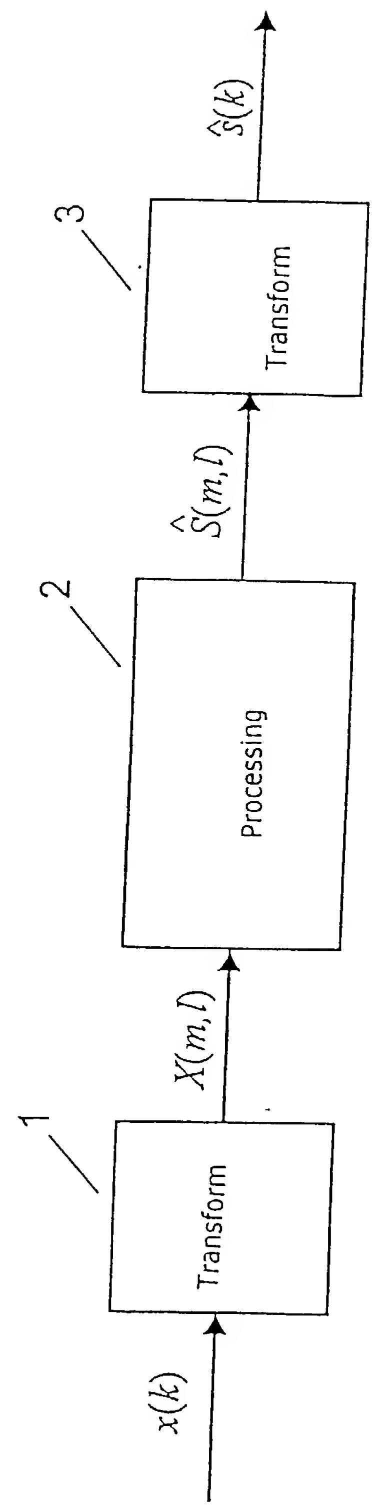


Fig 3

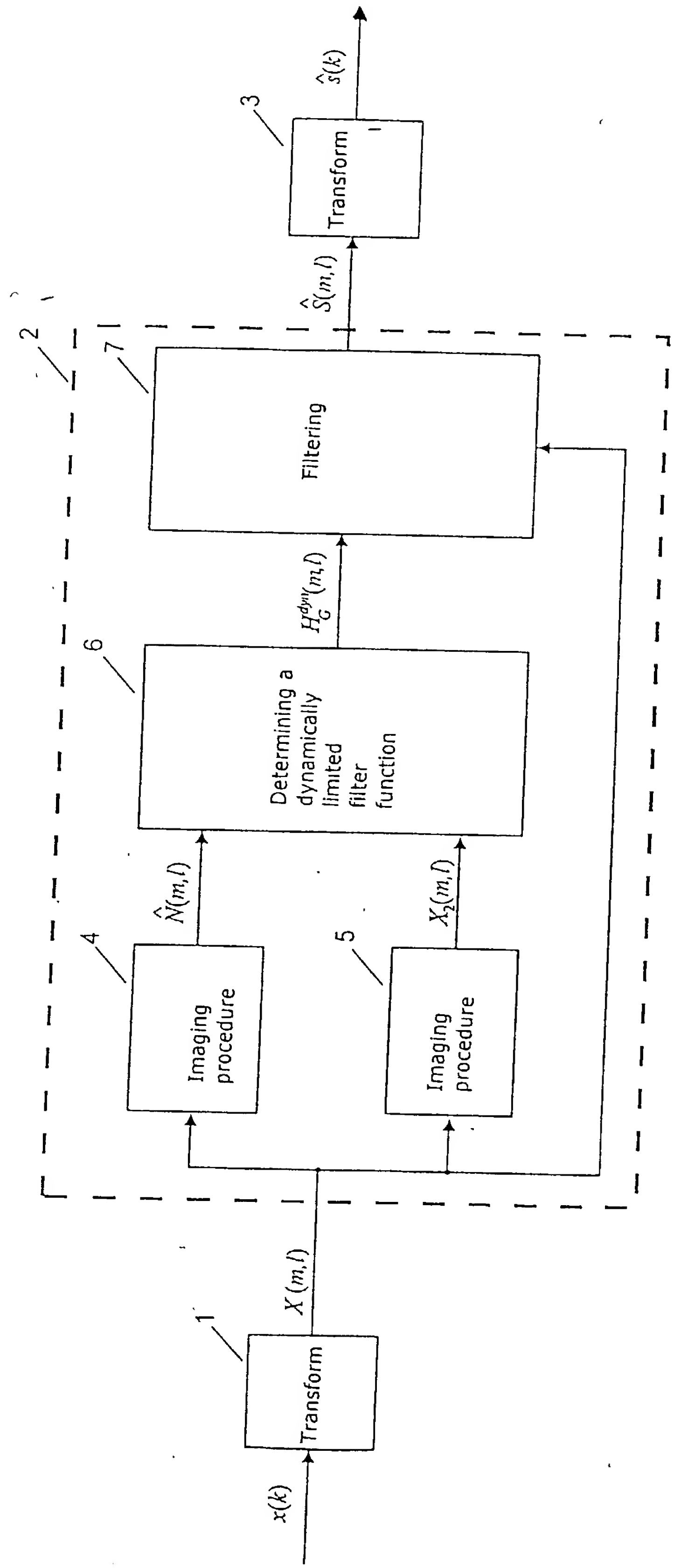
$x(k)$
1
Transform
$X(m,l)$
2
4
Imaging procedure
5
Imaging procedure
$\hat{N}(m,l)$
$X_2(m,l)$
6
Determining a dynamically limited filter function
$H_G^{dyn}(m,l)$
7
Filtering
$\hat{S}(m,l)$
3
Transform
$\hat{s}(k)$

Fig. 4

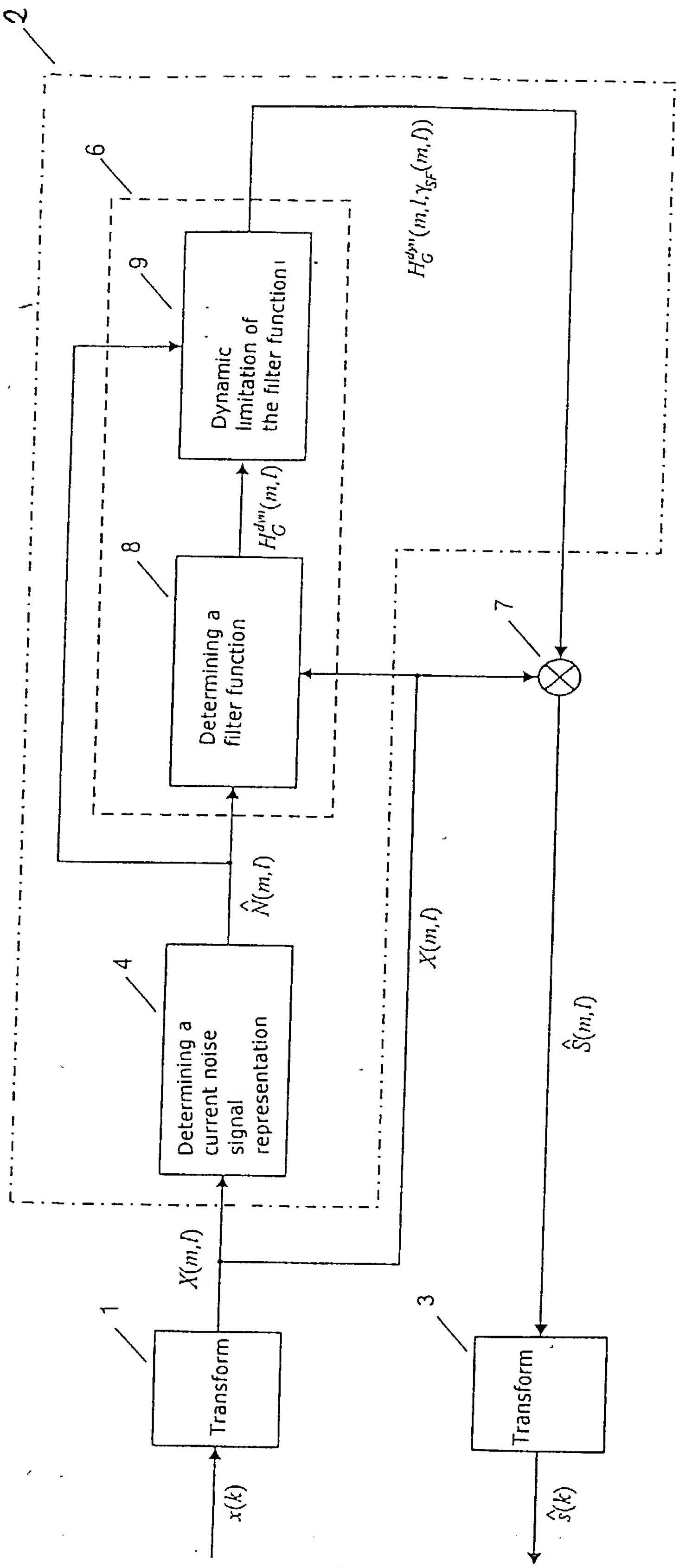
2
6
9
Dynamic limitation of the filter function
$H_G^{dyn}(m,l,\gamma_{SF}(m,l))$
8
Determining a filter function
$H_G^{dm}(m,l)$
7
4
Determining a current noise signal representation
$\hat{N}(m,l)$
$X(m,l)$
$X(m,l)$
$\hat{S}(m,l)$
1
Transform
$x(k)$
3
Transform
$\hat{s}(k)$

Fig. 5

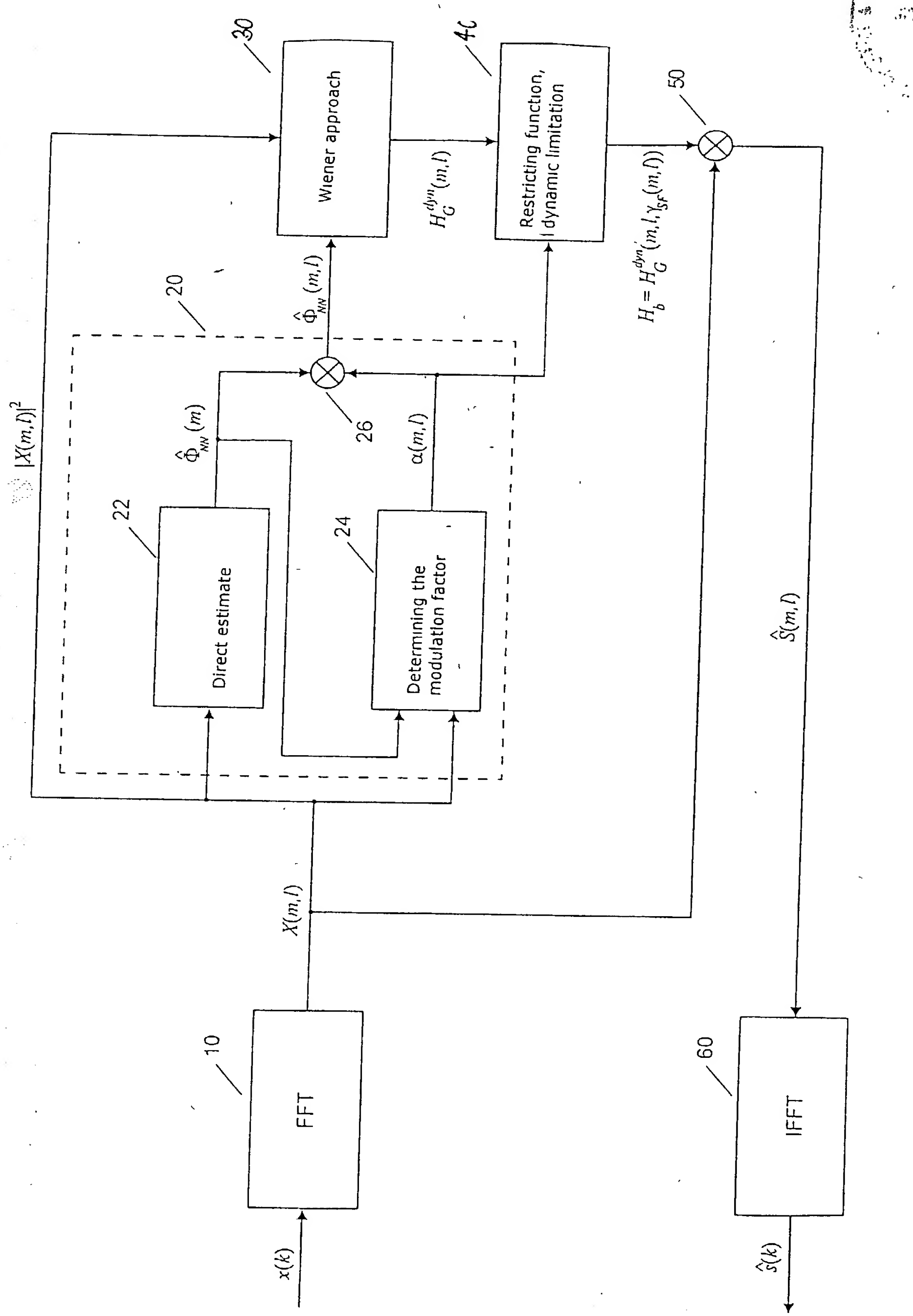
30
Wiener approach
40
Restricting function, dynamic limitation
50
20
22
Direct estimate
24
Determining the modulation factor
26
10
FFT
60
IFFT
$x(k)$
$X(m,l)$
$|X(m,l)|^2$
$\hat{\Phi}_{NN}(m)$
$\alpha(m,l)$
$\hat{\Phi}_{NN}(m,l)$
$H_G^{dyn}(m,l)$
$H_b = H_G^{dyn'}(m,l,\gamma_{SF}(m,l))$
$\hat{S}(m,l)$
$\hat{s}(k)$

Fig. 6

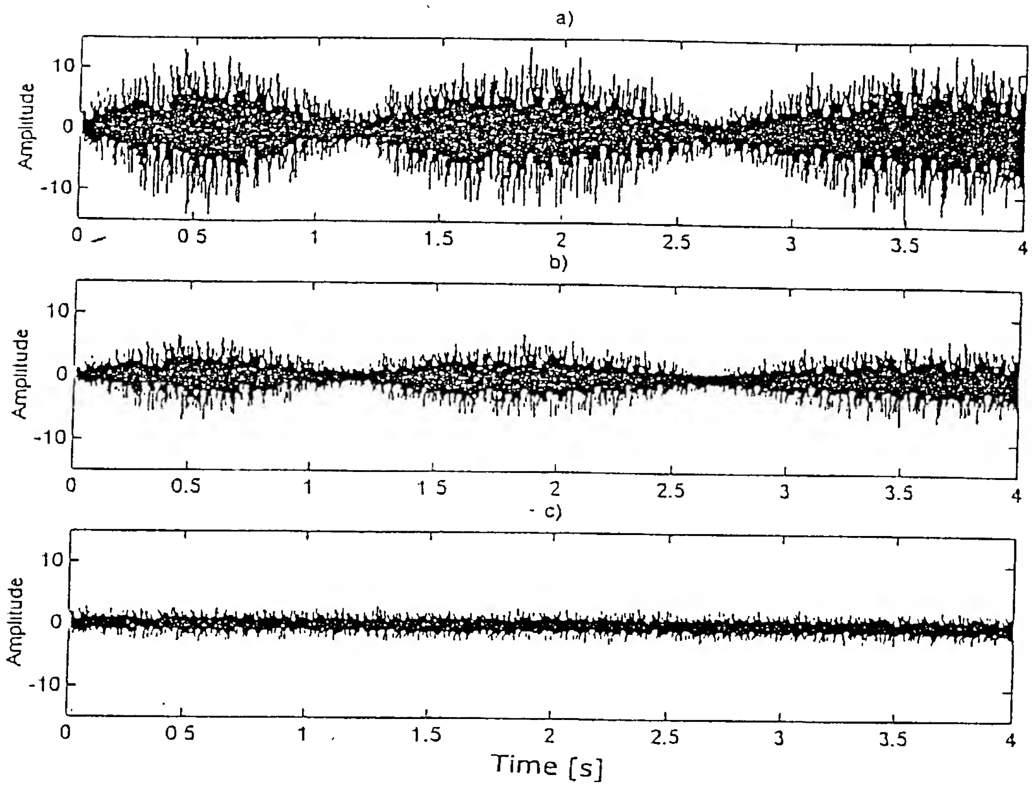
a)
Amplitude
10
0
-10
0
0.5
1
1.5
2
2.5
3
3.5
4
b)
Amplitude
10
0
-10
0
0.5
1
1.5
2
2.5
3
3.5
4
c)
Amplitude
10
0
-10
0
0.5
1
1.5
2
2.5
3
3.5
4
Time [s]

Fig. 7

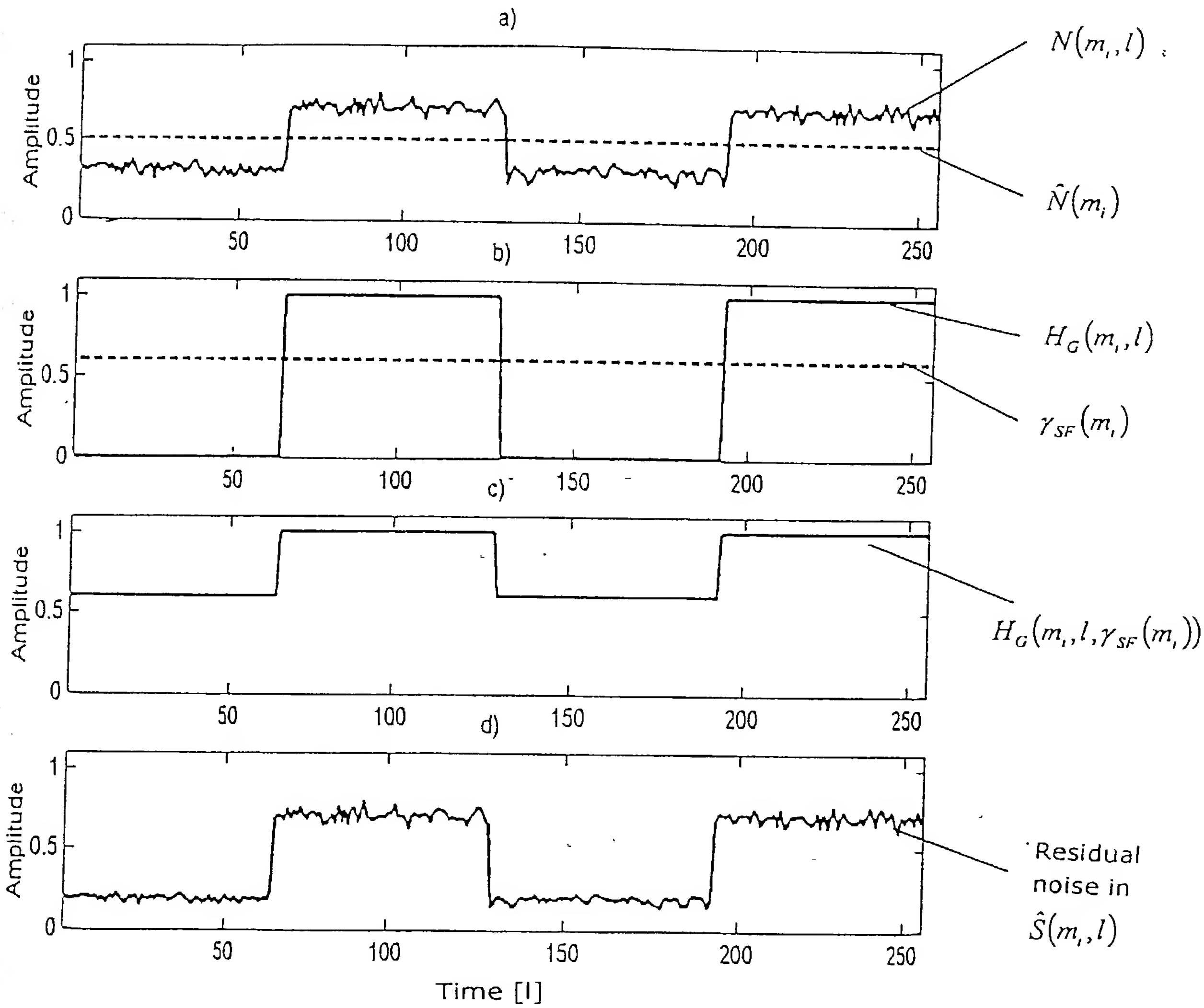
a)
b)
c)
d)
Amplitude
Time [l]
$N(m_i, l)$
$\hat{N}(m_i)$
$H_G(m_i, l)$
$\gamma_{SF}(m_i)$
$H_G(m_i, l, \gamma_{SF}(m_i))$
Residual noise in $\hat{S}(m_i, l)$

Fig. 8

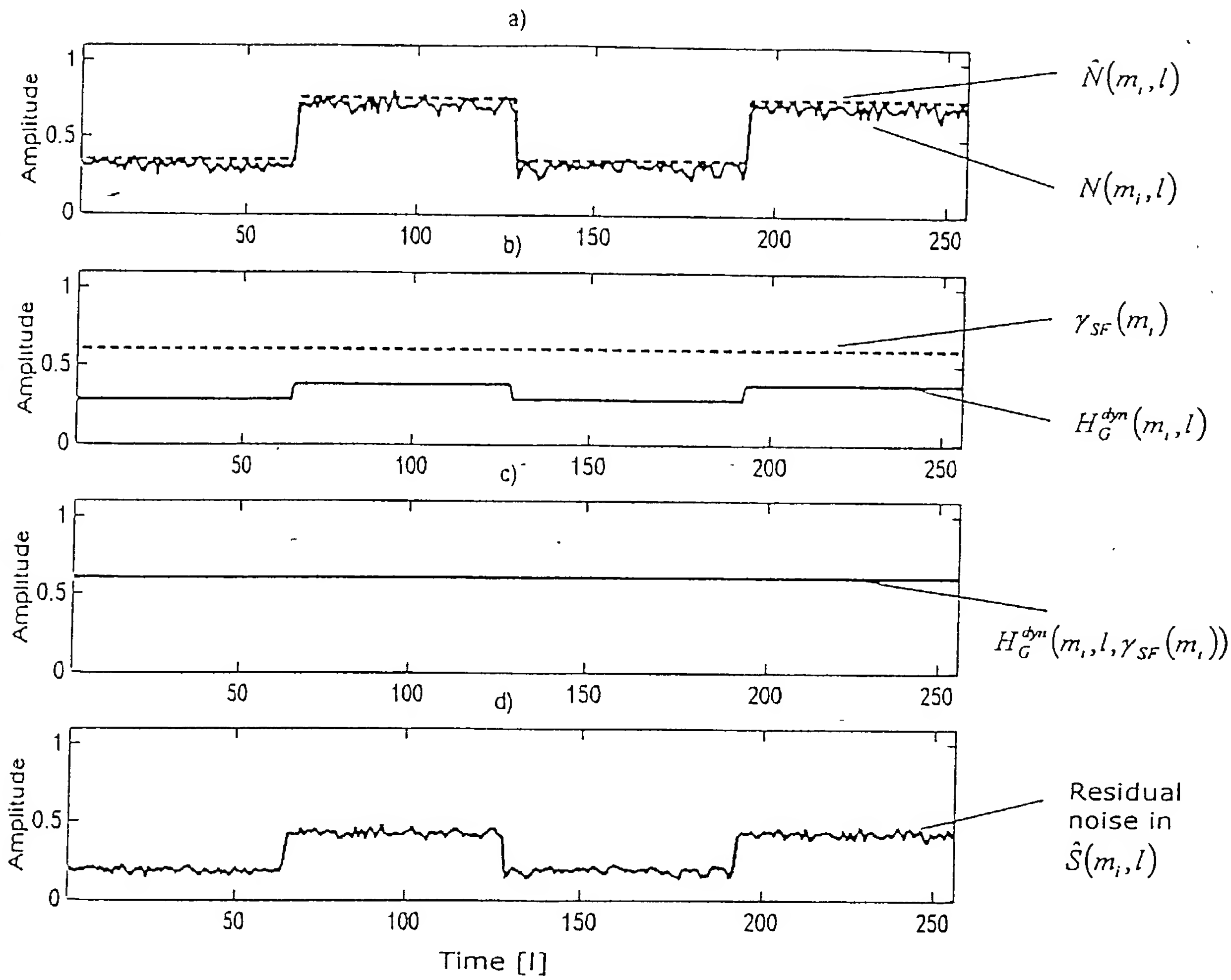
a)
Amplitude
1
0.5
0
50
100
150
200
250
$\hat{N}(m_i,l)$
$N(m_i,l)$
b)
$\gamma_{SF}(m_i)$
$H_G^{dyn}(m_i,l)$
c)
$H_G^{dyn}(m_i,l,\gamma_{SF}(m_i))$
d)
Residual
noise in
$\hat{S}(m_i,l)$
Time [l]

Fig. 9

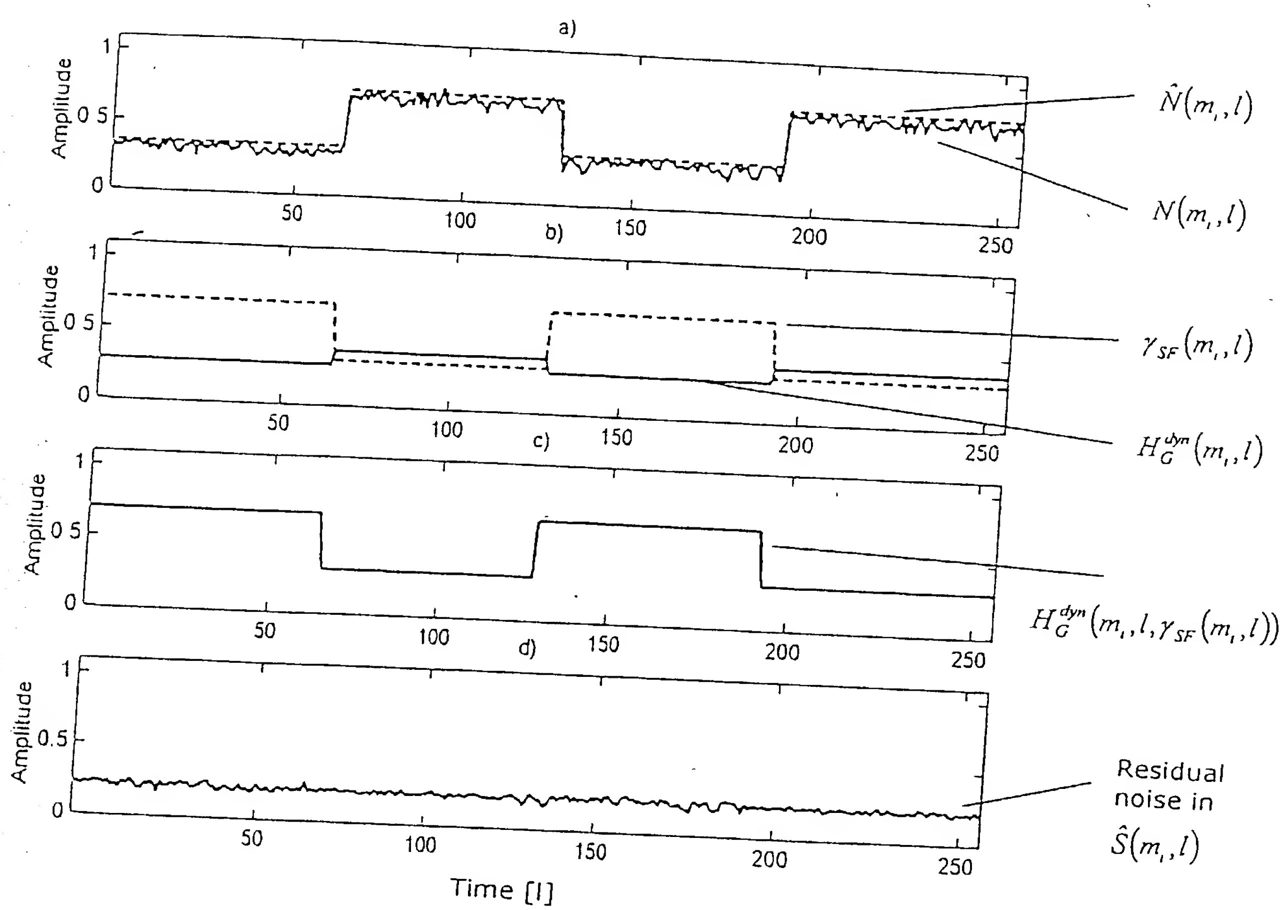
a)
Amplitude
1
0.5
0
50
100
150
200
250
$\hat{N}(m_i,l)$
$N(m_i,l)$
b)
$\gamma_{SF}(m_i,l)$
$H_G^{dyn}(m_i,l)$
c)
$H_G^{dyn}(m_i,l,\gamma_{SF}(m_i,l))$
d)
Residual noise in $\hat{S}(m_i,l)$
Time [l]

Fig. 10

Drawing legend

Figure 7: Explanation of the advantages of the method of the invention in comparison with the state of the art:

a) configuration in respect of time of the non-stationary noise component of an audio signal with random, continuous non-stationary noise

b) resulting, non-stationary residual noise after processing of the noisy signal in accordance with the state of the art (2nd known method)

c) resulting, stationary residual noise after processing of the noisy signal with the method of the invention

Figure 8: Diagrammatic mode of operation of the limited STSA method with non-stationary noise interference:

a) representation of the noise interference $N(m_i,l)$ of a discrete frequency $m_i$ (quantity square of the Fourier transforms) and its stationary estimate $\hat{N}(m_i)$ in dependence on time $l$

b) resulting filter function $H_G(m_i l)$ of a discrete frequency $m_i$ and associated stationary spectral bottom $\gamma_{SF}(m_i)$ in dependence on time $l$

c) resulting restricted filter function $H_G(m_i,l,\gamma_{SF}(m_i))$ of a discrete frequency $m_i$ in dependence on time $l$

d) resulting residual noise in the output signal $\hat{S}(m_i,l)$ in dependence on time $l$

Figure 9: Diagrammatic mode of operation of an embodiment of the known method when using an estimate of the currently contained noise signal component which describes the change in respect of time of the noise, for determining the filter function $H_G^{dyn}(m,l)$ and the restriction thereof by means of a restricting function $\gamma_{SF}(m)$ which is constant in respect of time:

a) representation of the noise interference $N(m_i,l)$ (quantity square of the Fourier transforms) of a discrete frequency $m_i$ and its estimate by the method of the invention in dependence on time $l$

b) resulting filter function $H_G^{dyn}(m_i,l)$ of a discrete frequency $m_i$ and associated stationary spectral bottom $\gamma_{SF}(m_i)$ in dependence on time $l$

c) resulting filter function $H_G^{dyn}(m_i,l,\gamma_{SF}(m_i))$ of a discrete frequency $m_i$ in dependence on time $l$

d) resulting residual noise in the output signal $\hat{S}(m_i,l)$ in dependence on time $l$

Figure 10: Diagrammatic mode of operation of the method according to the invention:

a) representation of the noise interference $N(m_i,l)$ (quantity square of the Fourier transform) of a discrete frequency $m_i$ and its estimate $\hat{N}(m_i,l)$ by the method of the invention in dependence on time $l$

b) resulting filter function $H_G^{dyn}(m_i,l)$ of a discrete frequency $m_i$ and non-stationary spectral bottom $\gamma_{SF}(m_i,l)$ which is determined by the method according to the invention in dependence on time $l$

c) resulting dynamically restricted filter function $H_G^{dyn}(m_i,l,\gamma_{SF}(m_i,l))$ of a discrete frequency $m_i$ in dependence on time $l$

d) resulting residual noise in the output signal $\hat{S}(m_i,l)$ in dependence on time $l$